November 15 -17, 2005: Town & Country Convention Center - San Diego, CA

Network Rationalization (NR)

Mike Davis
SCN Coordinator and Afloat Rationalization
PEO C4I & Space – PMW 160.TD.1
16 November, 2005

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FORCEnet Chief Engineer

Agenda / Topics

- **Understanding the problem**
- **PMW 160 mission and focus**
- **Enterprise Network Vision**
- **Network Rationalization**
- **Network study/verification**
- **Summary**

Only as a TEAM will we provide effective network services

Understanding the Problem
Current Network Environment

- Wide proliferation of networks
  - Up to 50+ separate networks on a ship
    - Multiple claimancies
    - High life cycle costs and sysadmin requirements
    - Sporadic, slow, and expensive tech refresh
  - Inconsistent application of Information Assurance
    - Physically separate security enclaves (MLS Solutions not widespread)
- Result
  - Interoperability Issues
    - Significant challenges - Cost intensive
    - E2E Configuration management ineffective
  - Barrier to FORCEnet and NCES migration

Why Can't We Migrate to an Enterprise Network Architecture?

Why is this Happening?

- Narrow view of warfighter's application environment
  - Stove-piped instead of integrated environment
  - Hundreds of disparate applications/connections to support (PPL/SSIL)
- Perception Networks are "easy"
  - Anyone can build one
  - Limited understanding of support and lifecycle costs
- Policy? CONOPS? Operational differences?
  - No universal set of network requirements
  - Various network providers competing, different standards, performance objectives, etc.
- Perception CFE saves money (especially in SCN)
  - Lower integration cost ≠ Lower life cycle cost

Commonality Across the Network Spectrum Needed

FY-06 Numbered Fleet Top Ten Requirements

R 041359Z OCT 05 COMSECONDFLT

it was clear that the **overarching need** is to **apply the standards, redundancy, and reliability of weapons systems to the fleet's** communications and **information systems**

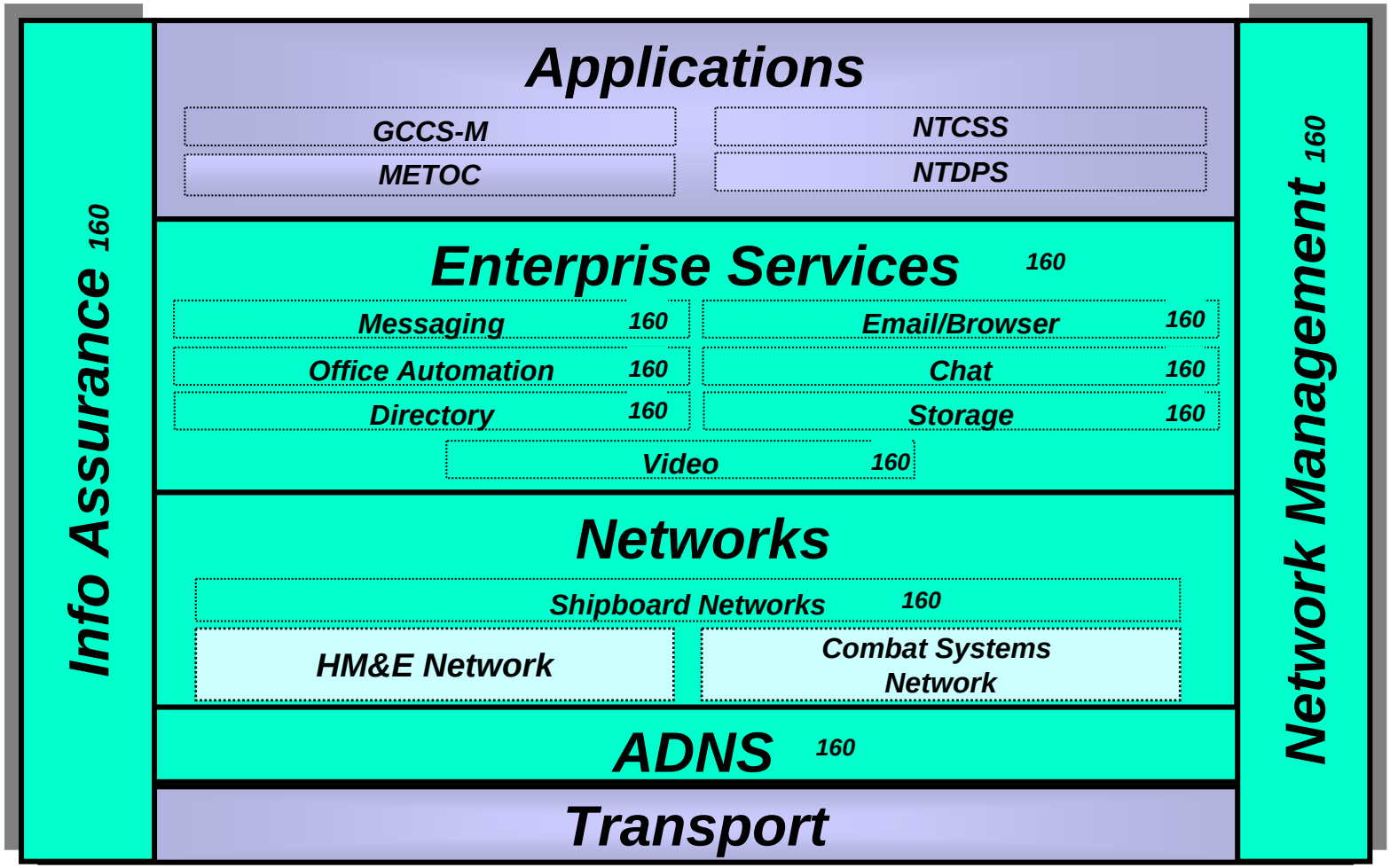
1. ***Coalition* communications**
2. **Reliable SATCOM**
3. ***Standards*** *(see excerpt below…)*
4. **Lack of adequate *data throughput***
5. ***Computer network defense (CND).***
6. **Common operational picture (cop).**
7. **Real-time *collaboration***
8. ***Streamlined process* to support emergent ops**
9. **Next generation *knowledge management***
10. **Incorporate *wireless technology.***

(areas which will benefit from network collaboration)

(3) Standards. ..information systems are critical war-fighting infrastructure and require operating, training and maintenance standards equivalent to those in weapons systems.... (a) .. significantly more rigor in development of procedures and training…there should be **uniform configuration and procedures** throughout the navy infrastructure. (aka **COMMONALITY**!)

PMW 160's Mission

Managing the Afloat Network Enterprise



PMW 160 is responsible for most of the Afloat C4I Architecture

PMW 160 Programs / Projects

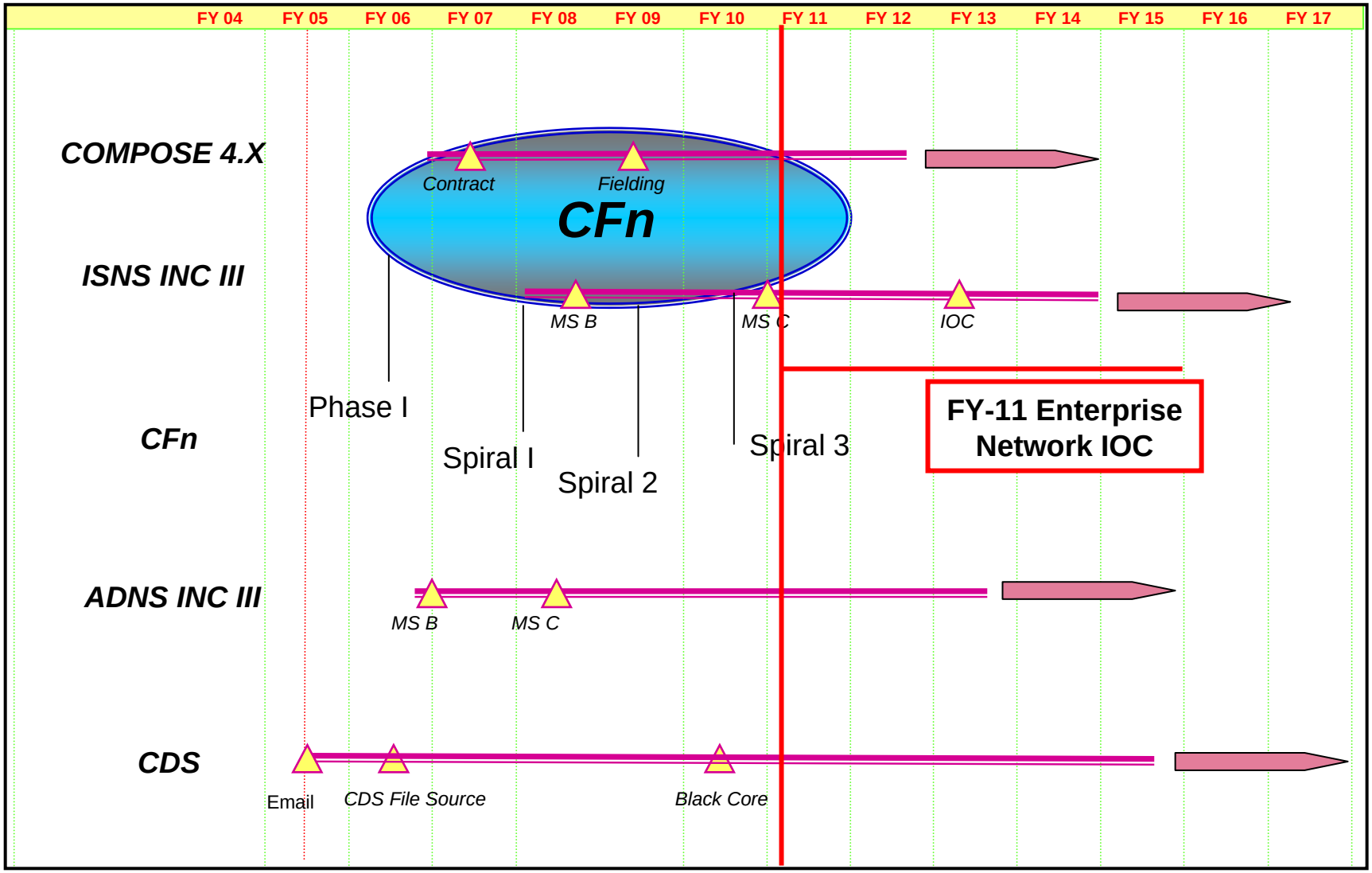
Navy Acquisition and Technical Authority for Networks, Information Assurance, and Enterprise Services

Afloat Networks	CRYPTO & Key Mgt.	Enterprise Services	Network Security
ISNS	*KG-3X*	*DMS*	*JCDX*
ADNS	*KG-40AR*	*Tactical Messaging*	*CND*
SCI Networks	*DMS Infosec CAW*	*NGDS*	*CDS*
SubLAN	*Crypto Products*	*NMCP*	*DII Guards*
CENTRIXS-M	*EKMS*	*COMPOSE*	*IA Readiness Services*
VIXS	*PKI*	*TDAMS*	*NMCI IA*
Workstations (PCs)	*Identity Management (Biometrics)*	*Network Management*	*Radiant Mercury*
	Secure Voice	*Naval Regional Enterprise Messaging (NREMS)*	
	Crypto Mod		

Each program / project has E2E acquisition support including: LCS/ILS, EoL, ISEA support, and cross-functional integration.

PMW 160 Road Map

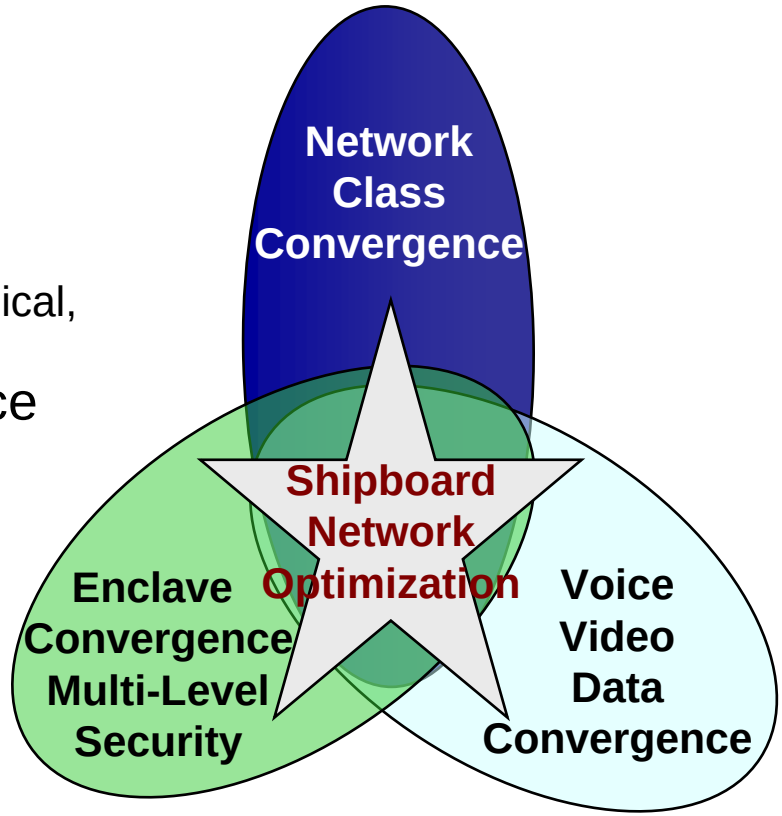
Advancing and integrating capabilities



ENTERPRISE NETWORK VISION

Enabling FORCEnet through standards/commonality

- Network class convergence
  - IT21 “C4ISR” Network
  - HM&E “Control” Networks (SmartShip)
  - Combat System “C&D” Networks
  - Nuclear Propulsion Network
  - Other Applications/Systems (Aviation, Medical, IC/voice, Embarkables, etc)
- Network Security Enclave Convergence **(Multi-level security / Cross Domain Solutions)**
  - Unclass
  - Secret (including coalition)
  - Top Secret
  - SCI
- VVD Convergence
  - Voice
  - Video
  - Data



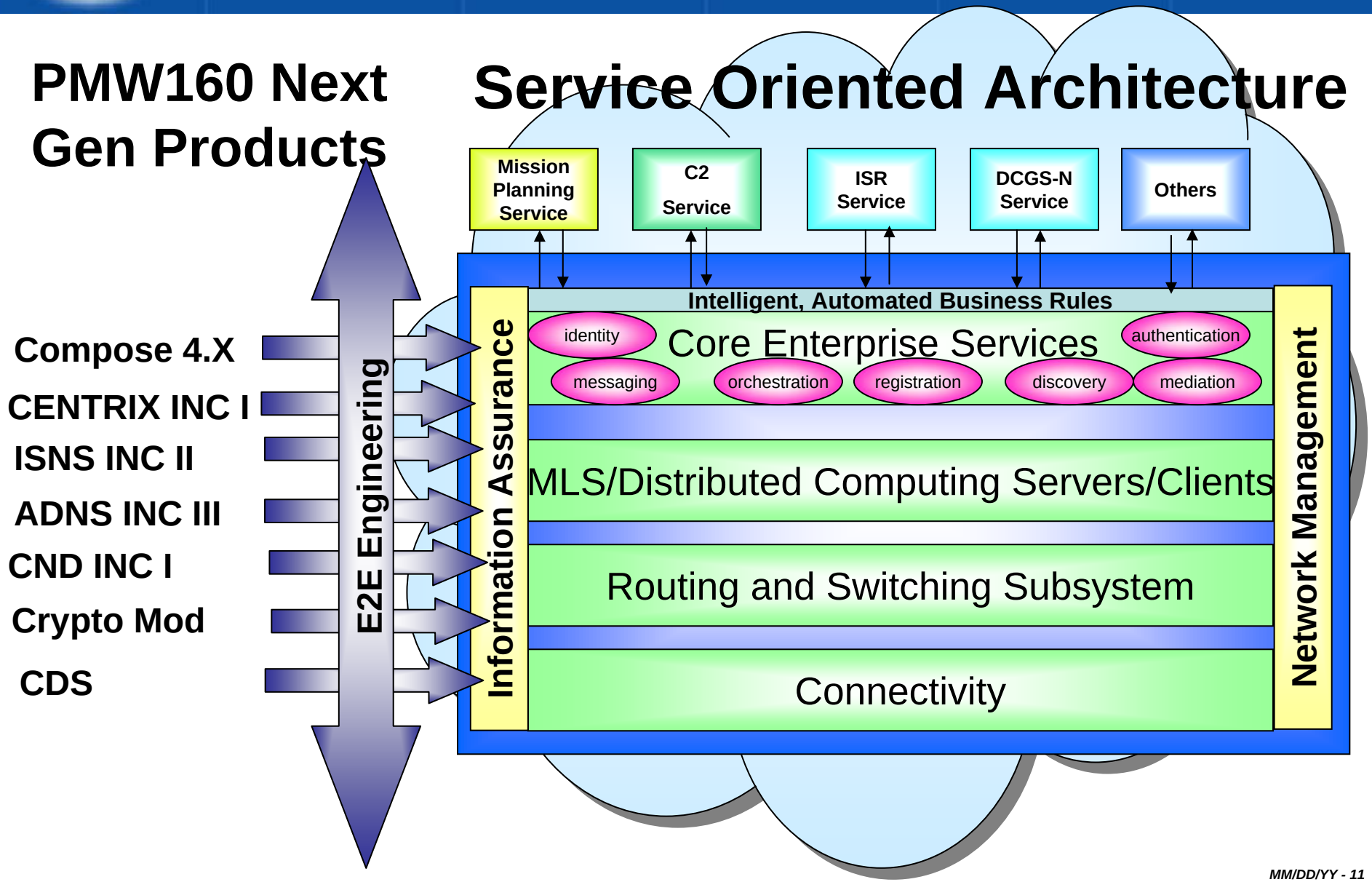
UNIFORM network services provider(s)

E.g, afloat ISPs providing common “hotel services”

What is being done about “Optimizing the Network”?

PMW160 Next Gen Products

Service Oriented Architecture



Network Assessment Activities

- **SPAWAR 05's Network Consolidation Study #2,**
  - As directed by ASN RDA, M&S effort will focus on big-deck amphibious assault ships.
- **PMW 160's Network "Deep Dive" Efforts**
  - Technical look at the network's "roadmap" and the "as-is" afloat networks.
  - Survey/Study will include a review of enterprise/whole ship requirements.
  - Leading an overarching "network rationalization" initiative
- **Finalizing CPD/CDD for ISNS Increment 2 & 3**

We're TEAMING and need your inputs!

Establishing a Network Enterprise
Basic "Network Rationalization" Intent

Hypothesis: **There is a "best" most effective way to provision networks afloat**,

… based on resolving user issues and fully enabling E2E information exchange globally *(previous studies/surveys and NCW/FCL reqs),*

… where the network equation has many threads that need to be at least considered in any solution *(e.g., E2E LCS and DOTMLPF elements, so the full impact and costs are known – afloat and ashore),*

… providing quantifiable information superiority benefits and future capability enhancements to all users, and

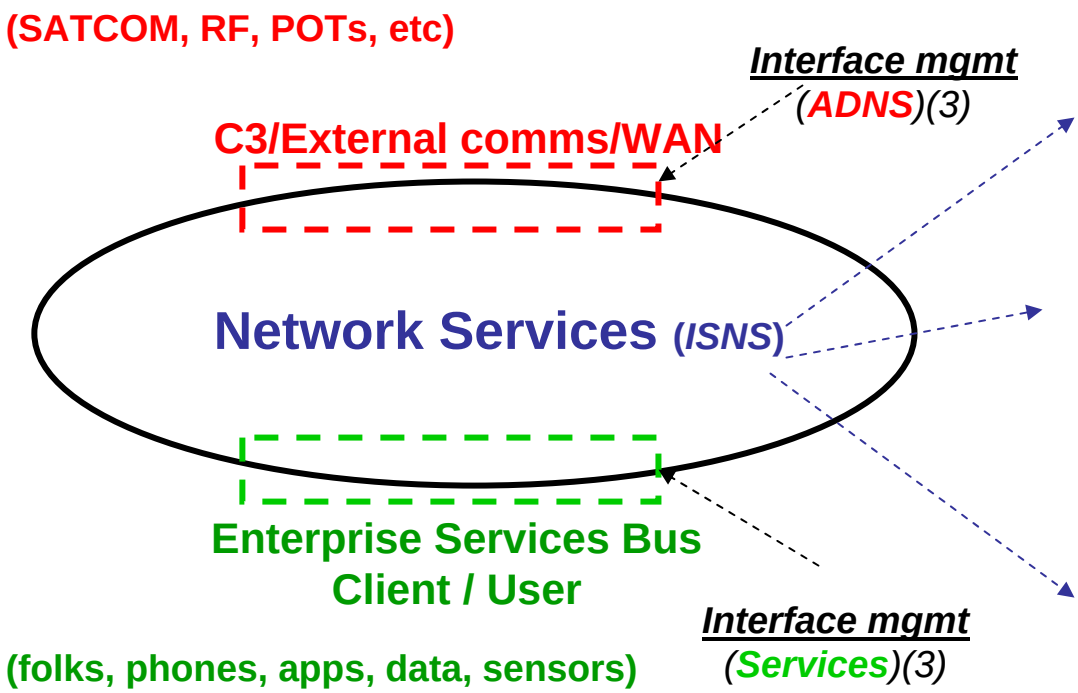
the best way to get there is close teamwork in a combination of federation, effective consolidation and transparent network services (which mimics utility/hotel services)

Network Rationalization (NR)
Definitions and Functional Decomposition

NR = Network Services + Systems Management

Network Services = business rules, CM, standards, etc

System Management = Interfaces, reqs, Prg. Mgmt, ETC!



(1) Standards/Common items:
HW, SW, CS/CM, RAM, Metrics, protocols, ETC!
(e.g., IT is a commodity)

(2) "Business" rules:
Quantify network reqs into capability "buckets" and performance levels (aka – COS/CLINs and SLAs)

(3) "System MGMT":
Includes ALL other NR support!
Customer ADVOCATE

Network Rationalization (NR)
Overall Precepts/Tenets

- **Mission** – *Quantify the afloat network reference architecture and offer those capabilities in a collaborative network services environment*
  - NR is an **overarching approach** to systematically achieve the challenge of providing a "best value" in **mission critical network services** with common hardware, software, processes, interfaces/standards, QoS & requirements.

- **Objective** – *Provide reliable, efficient and effective network services for all classification levels for mission critical systems on all afloat platforms* while:
  - (1) providing dynamic response IAW the commanders intent with emergent battle space needs,
  - (2) enabling FORCEnet where the discovery and cooperation of services from disparate organization are fielded at different times, and
  - **(3) *transition to a full network services model through a combination of federation, consolidation and integration/convergence*.**
  - (4) Federation would have Two phases: (1) FIX WHAT'S BROKE & provide consistent services and (2) Formalize Federation R&R/ROE/MOA

Rationalization/Optimization Goals

(1) *REDUCE:* manning, footprint, hotel services, LCS elements, TCO/LCC

(2) *INCREASE:* interoperability, defense in depth, mission effectiveness and potential for added capabilities

- Reduced System Administration Workload
- Configuration Management CONOPS & Control
- Greater & More Uniform Security
- Tech Refresh & Simplified Refresh
- Lower Lifecycle Costs Across the Board
- Cross-Domain Solution/Coalition support
- Improved connectivity management
- Facilitate SOA/NCES/CFn implementation
- Reduced documentation effort (C&A, EA/views, etc)

160 Network Study & Survey

- Overview
  - Survey intended to be all inclusive to verify and document all aspects of afloat networks.
    - Starting with the re-discovery “as-is” phase of “NR” until key definitions and major NR objectives are framed and answered which validate the “to-be” model.
  - Deliverables: *Phase one* - reference architecture model, implementation methodology and survey instrument. *Phase two* – updated model, shipboard survey assessments, & initial AoA/BCA.

- Overall Approach
  - Capture the various networks and corresponding network performance requirements
  - Identify Common Services across networks/applications
  - Rank networks/systems by risk of integration/convergence
  - Propose a reference network architecture model
  - Verify assumptions and model through shipboard verifications
  - Recommend SCN and backfit rationalization opportunities
    - Based on an initial AoA/BCA (with a rough manpower/cost ROI)

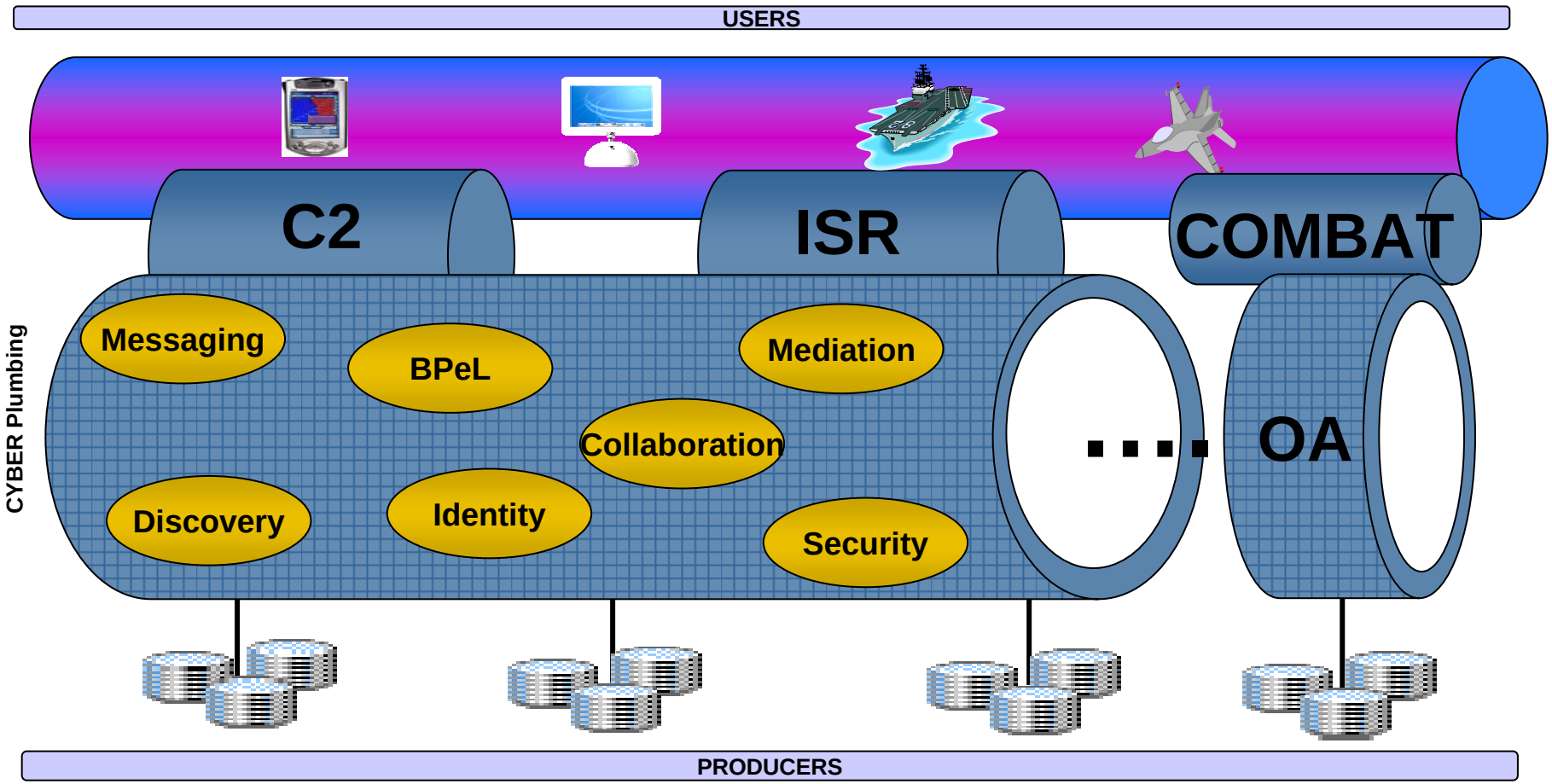
1. Identify all the various networks and corresponding network performance requirements

Identify all critical performance elements/parameters

*(example - ISNS Performance Requirements (Partial list *))*

Requirement	Threshold	Objective
Operational Availability (A_o)	≥ 95%	≥ 99%
Interoperability	100% of Critical IERs are satisfied	100% of Critical and Non-Critical IERs are satisfied.
Time taken for two workstations to transfer files to each other via the shipboard network. (2.5 Megabyte File)	≤ 1 min.	≤ 20 sec.
Time taken for workstation to transfer files from one of the servers via the shipboard network. (2.5 Megabyte File)	≤ 1 min	≤ 5 sec.
Average Bandwidth utilization of the link between the servers and the backbone switch over the period of 24 hours. (Peaks may exceed threshold for no more than 5 minutes per hour)	≤ 66%	≤ 33%

2. Identify Common Services across networks & applications (based on NESI, OACE, NCES)



3. Rank by risk of integration / convergence

- Federation
- Consolidation
- Network Hotel Services

Sample opportunity & suitability Matrix

(1) Cable/Fiber type (i.e., single-mode, multi-mode)
(2) Network architecture (e.g., FDDI, ATM, Gig-e)
(3) Operating systems (e.g., Unix, Windows , VXwroks)
(4) Performance/Quality-of-Service (e.g., latency, real time, Ao)
(5) Class of Network (unclass, coalition, NOFORN, etc)
(6) Certifications required (i.e., C&A , WPNs)
(7) Environment (HM&E, WPNS, external)
(8) System engineering complexity (coupling, IA, etc)

Relative risk potential (9)

Critical discriminators

	1	2	3	4	5	6	7	8	9
A									
B									
C									
D									
E									
F									
G									

NETWORKS

(A) ISNS
(B) HM&E
(C) CBS/WPNs
(D) Aviation
(E) Embarkables
(F) NNPI
(G) ETC…

Engage programs & networks based on lowest risk first

What's in this for Users/Stakeholders?

- **ONE focused network service provider TEAM**
  - One stop shopping for capabilities and issues
  - Concentrated program management focus and effort
- **Reduced resources**
  - Manpower reductions afloat – beyond just automation
  - Less TCO in LCS – much more commonality
  - Network services provided as "hotel services"
- **More reliable information transfer globally**
  - Consistent interoperability and strategic focus
  - Focused concentration on DoD/Federal interfaces
  - More complete and assured "defense in depth"
- **Added mission capabilities and effectiveness**
  - Enables NCW/FCL level three capabilities and beyond
  - Supports new "killer" apps and personal all-in-one devices
  - Morphs network services into a transparent commodity

Our TEAM takes care of the network, so you concentrate on business

Summary/Recommendations

- *Embrace NR need & approach*
- *Collect facts/data - Conduct M&S & shipboard surveys*
- *Way forward - engage teammates & build consensus*
- *Deliverables – define key items and plans*
- *Collectively Answer the mail*
  - *"R 041359Z OCT 05 COMSECONDFLT … apply the standards, redundancy, and reliability of weapons systems to ..information systems…"*
  - *Enhanced readiness, current and future, affordability*
  - *STANDARDS, manpower effectiveness (reduction), streamlined processes*

Suggestions and Questions?

Back-Up Slides

NR must enable NCW/FCL Capability levels

SCN / CVN21 target

Through: Commonality, validated NETWORK requirements, secure interoperability

Based on Fn Concept Document

Full IT21
"Online"

- IP Reach Back
- Local Area Networks
- Wideband Receive
- RF Management
- Survivable comms

Level 0

Today

Net Connected
"Improved decision making"

- Web-based services
- Improved network reliability and performance
- Increased bandwidth
- Improved coalition operations and data sharing
- Tailorable situational awareness tools
- Standardized data exchange between domains
- Defense in depth

Level 1

FY07

Net Enabled
"Network based command and control"

- Multi-path and improved transport reliability
- Dynamic bandwidth mgmt
- Customized applications and data sources
- Common infrastructure and data exchange standards
- Improved data exchange across domains
- Enterprise management for asset analysis and repair
- Initial knowledge management and automated decision aids
- Assured sharing
- Distributed command and control operations
- Modular and open architecture

Level 2

FY10

Fully Net Ready
"Decision-making under undesirable conditions"

- Robust, reliable communication to all nodes
- Reliable, accurate and timely information on friendly, environmental, neutral and hostile units
- Storage and retrieval of authoritative data sources
- Robust knowledge management capability with direct access ability to raw data
- User-defined and shareable SA
- Distributed and collaborative command and control
- Automated decision aids to enhance decision making
- Information assurance
- Seamless cross-domain access and data exchange.
- Interoperability across all domains and agencies
- Autonomous and disconnected operations
- Automatic and adaptive diagnostic and repair
- Modular architecture to expedite new capabilities

Level 3

FY14

FORCEnet Network Elements

- **IT-21—The Navy Warfighting Network**
  - Shipboard LANS, C4I Equipment
  - Shore Connectivity Elements
    - NCTAMS/NCTSs
    - Fleet NOCs
    - DoD Teleports/STEP Sites

PMW160 Charter

Implement an integrated, interoperable network infrastructure as well as basic network management and information distribution services afloat.

- **BLII OCONUS (ONE-NET)**
  - Shore Based User Workstations, Servers, LANs, WANs—OCONUS except Hawaii
- **NMCI**
  - Shore Based User Workstations, Servers, LANs, WANs—CONUS and Hawaii

PMW160 provides more than just the physical networks; we synchronize capabilities across the Naval Enterprise

Challenges & Opportunities

Towards providing common services

Overall DoD funding scarce and decreasing

GWOT, Katrina, competing priorities, IT commodity perception

Multitude of similar yet disparate networks

Stove-piped programs diverse funding lines, timelines and requirements

Competition between network service providers

How to foster commonality, yet preserve the benefits of a few sources

Unified set of top-down, overall network requirements

Proliferation of capabilities exist (NCW/FCL), yet not parsed to networks

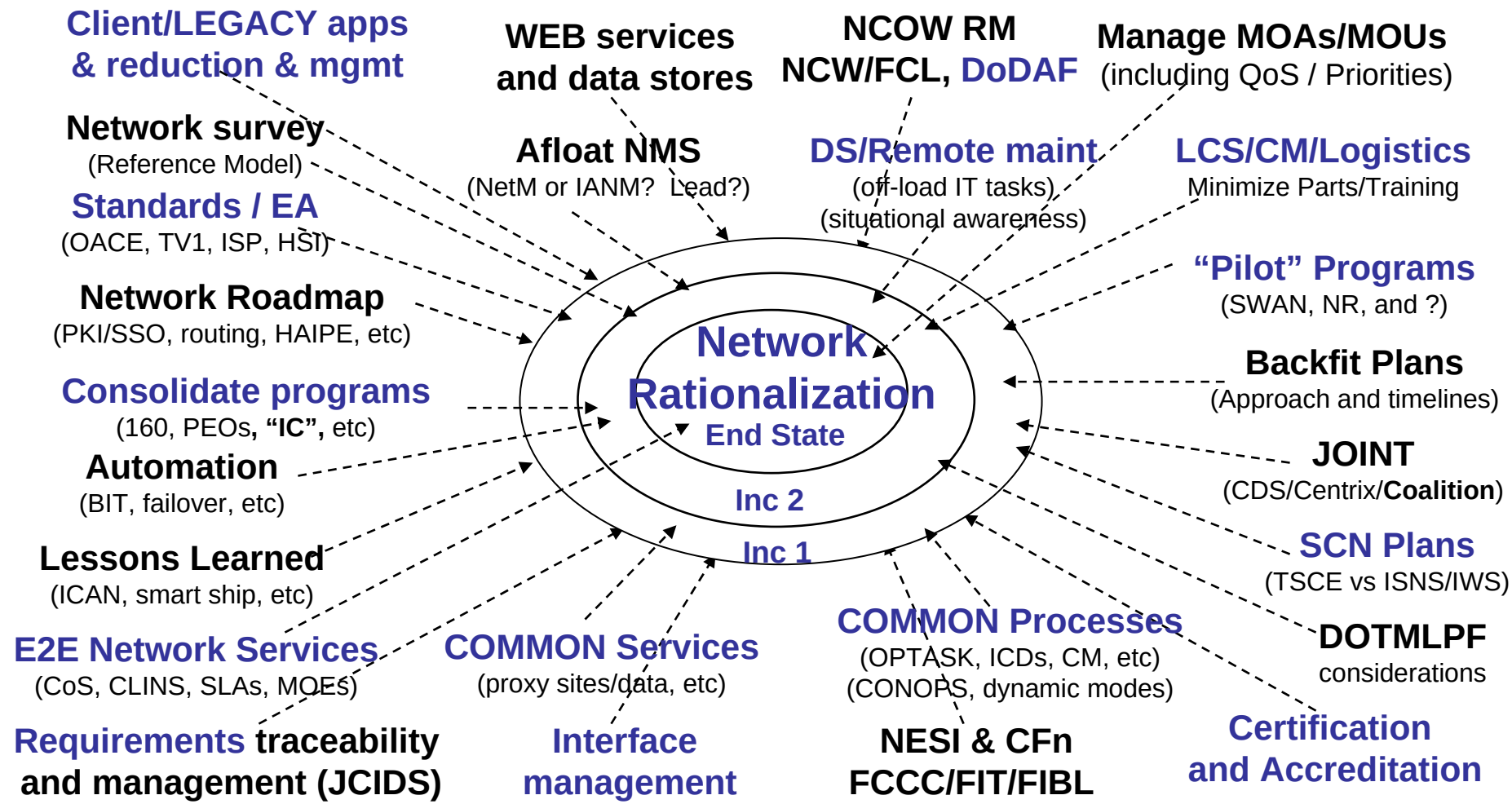
Commonality, commonality, commonality

Parts, processes, CONOPS, standards, tools, CM, 3M, comms, etc…

Collectively transition each challenge into a DoN opportunity

NR Relationships

Rationalization has many inter-related threads and variables



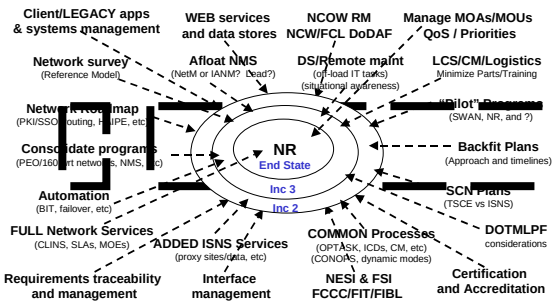
NR team's approach must collectively accommodate key elements

Notional "NR" approach

Integrate several methodologies/approaches: (1) Federation, (2) consolidation, and (3) full network services provider

(1) *Federation* of services and processes

(2a) PEO programs "*internal*" consolidation



(2b) Pilot/backfit "*external*" consolidation

"End-State"

FULL SERVICE NETWORK

(e.g., "hotel services" @ FCL 3)

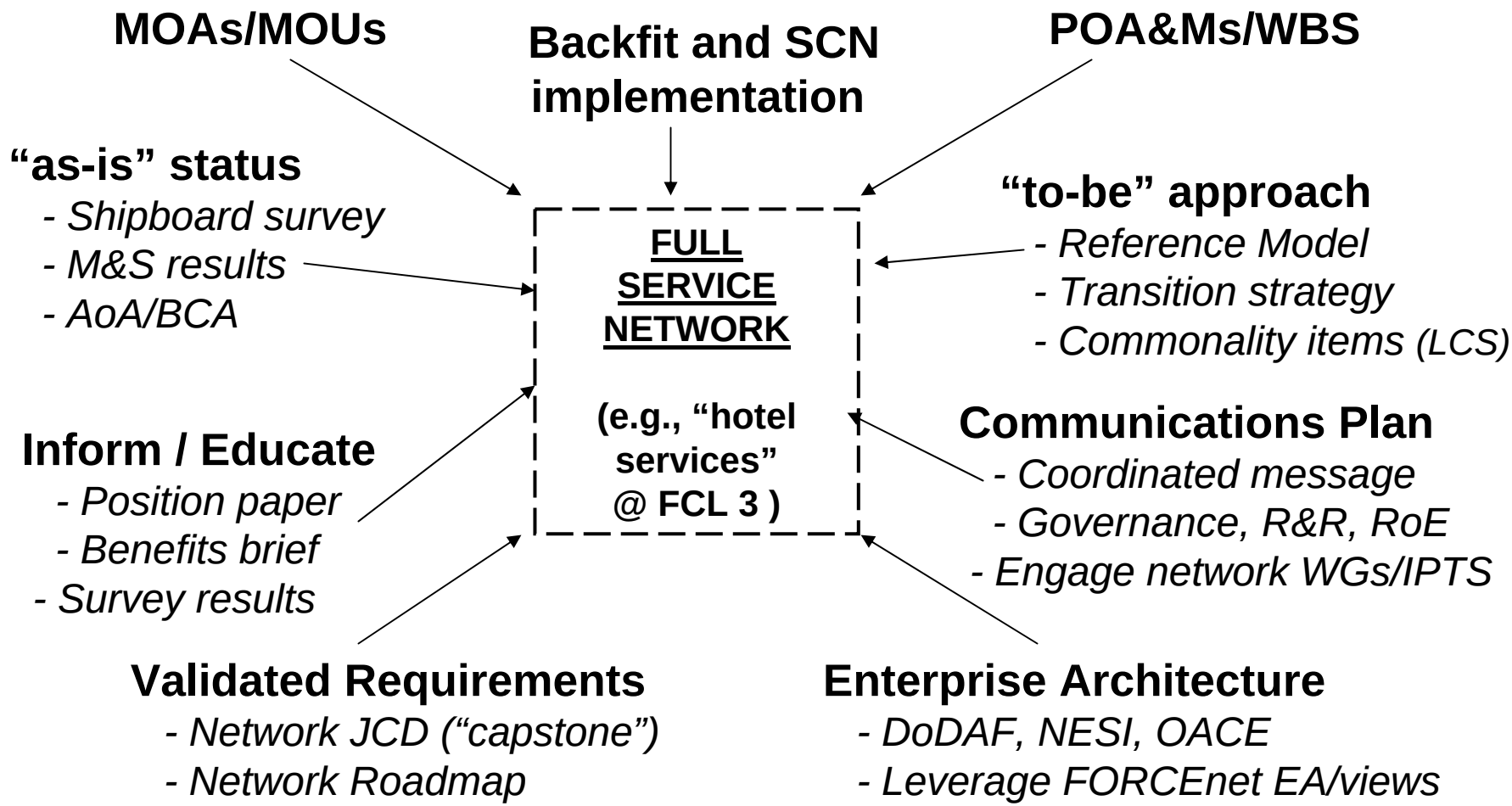
(3) Define / Offer *Classes of services / SLAs*

Today

FY 12-14

NR Elements / Deliverables

(efforts needed to transition "as-is" to "end-state")



Collaboration required to achieve commonality & economies of scale

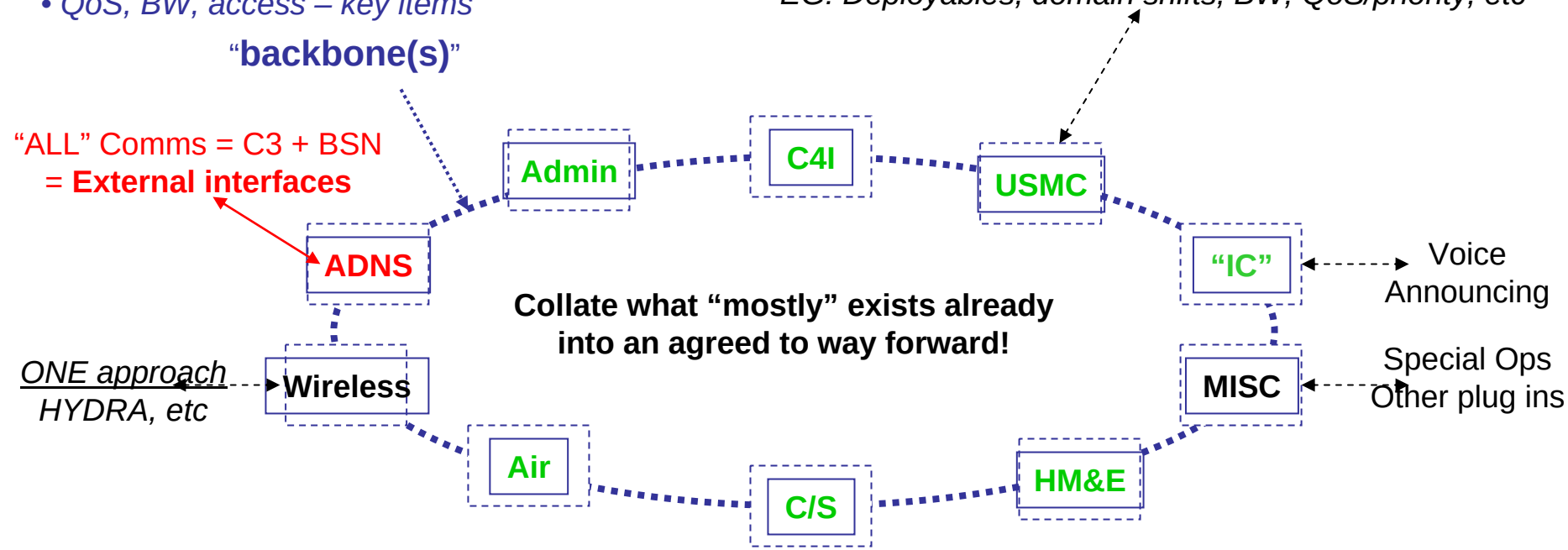
Network Rationalization (NR)
Functional Approach

- *Infrastructure part of "NR"*
- *ID reqs and current status*
- *QoS, BW, access – key items*

MAP each functional area requirements and interfaces.
EG: Deployables, domain shifts, BW, QoS/priority, etc

"**backbone(s)**"

"ALL" Comms = C3 + BSN
= **External interfaces**



XXX = PoP(s)

Functional areas (and "LANs" therein) will have several

Networks
Services/clients
C3/off-ship

- **Functional areas (aka "LANs")** will have their **own data/info requirements** as well as **Pop/backbone interfaces** and **external connectivity (ADNS / BSN)**
- **Application** and **network "Services"** and **interfaces therein** need to follow common business rules and adapt to standards and protocols to facilitate backbone and external interface reqs…
- Key overall driver is "**commonality**" of parts, rules, and processes AND leverage existing elements (PPL, logistics/training/LCS, etc..)

Transformation Potential with ISNS INC III

Deliver the Fleet's Afloat C4I Network by improved speed of information flow and assured information access by enabling the tactical edge services:

- **Placing all C4I users on a protected network**
  - Establishes Tactical Enterprise Services
  - Ensures Warfighter access to the information they need
- **Increased network speed and access**
  - Fully integrated V/VOIP – fully enable IP convergence
  - Transformational client architecture
  - Tactical Edge Services for integrated afloat/shore SOA's
- **A "One Stop Shop" for shipboard network capability**
  - Consolidates networks, hardware and software
  - Increases network efficiency and supportability
  - Reduces network costs, including all O&S/OMN aspects

Paradigm shift – C4I applications only bring "delta" software

Network Stakeholders

ASN RDA TD
OPNAV 07 and **71**
PEO IWS
NAVSEA/HM&E PMs
CNO 75 and 76
PEO Carriers

NNWC – N6/EA/Networks Lead
PEO C4I (*100/700s PMs &TDs)*
DoN OACE
NAVAIR – Various Network PM(s)?
PEO Ships
Naval Reactors

PMs for SCN hulls: DDG(X), LCS, LPD-17, CVN-21 & also DCGS PM

SURFPAC/SURFLANT
NSWC Dahlgren
DARPA/NRL and/or JHU/APL

EMO/N43 and FTSC/RMC and FSET
NSWCDD – CNI, SACC-A
DISA/NSA/other federal agencies

PEO C4I - PMW 140, 150, 170, 180, 190… PMW 750, 760, 770, 790
SURFPAC/SURFLANT EMO/N43 and FTSC/RMC and FSET
For C4I/Network overviews - ISEA(s), Fleet NOCs, BG staff N6's, etc

Major "NR" Technical Elements

-- EA: NESI /FSI /FIT and OACE & DoDAF /ISP /IER (? supported by a "JCD" ?) **&** Network Strategy / Roadmap (GIG, JBMC2, C4I)

-- Core: (1) Services (Definition, Commonality) **& (2)** Processes (CM, COOPS, OPTASK, etc) **AND** GIG transparency (IA, NCES, BE, JTRS, TSAT, Teleport)

Target Shipboard Network Consolidation Levels

Level 1 Common Cable Plant	Level 2 Common Standards	Level 3 Common Infrastructure	Level 4 Connected Network	Level 5 Converged Network
◆ Shared tube plant, fiber, cables ◆ Shall integrate the required network cabling with the ship's existing fiber cable plant. ◆ Distinct networks will use their own individual fibers within common cable conduit or multi-strand fiber cables and may share fiber interconnection and drop boxes	◆ Active network components (routers, switches, hubs, servers, workstations, etc.) all adhere to a common set of identified standards ◆ Standards detailed in the FORCEnet Architecture and Standards document ◆ Increases potential for interoperability between system, once greater levels of interoperability and consolidation (Level 3-5) are pursued.	◆ Network components are of common manufacture to installed, in-service and supported IT network system(s) ◆ Networking components ◆ PC / Server hardware ◆ Software apps, standardized ◆ Network Management and IA toolsets	◆ Controlled network connections to other shipboard networks. ◆ Physically and logically connected ◆ Leverages commonality with other shipboard networks and provides increased connectivity supporting various network centric warfare and FORCEnet objectives.	◆ Most preferred level of consolidation. ◆ Consolidated network design integrates all network requirements into one of the four functional IT network infrastructures. ◆ Network system's requirements are met by integrating with and/or expanding an existing functional IT network infrastructure using network components of common manufacture.